

## N O T I C E

THIS DOCUMENT HAS BEEN REPRODUCED FROM  
MICROFICHE. ALTHOUGH IT IS RECOGNIZED THAT  
CERTAIN PORTIONS ARE ILLEGIBLE, IT IS BEING RELEASED  
IN THE INTEREST OF MAKING AVAILABLE AS MUCH  
INFORMATION AS POSSIBLE

NASA TECHNICAL MEMORANDUM

NASA TM-76113

INVESTIGATION OF THE EFFECT OF SPACE FLIGHT  
FACTORS ON CHROMOSOMES IN SEEDS

L. G. Dubinina

Translation of "Issledovaniya deystviya faktorov kosmicheskogo poleta na khromosomy i semenakh", IN: Strukturnyye Mutatsii v Opytakh s Crepis capillaris (Structural Mutations in Experiments with Crepis capillaris), Moscow, "Nauka" Press, 1978, pp 106-107



INVESTIGATION OF THE EFFECT OF SPACE FLIGHT FACTORS  
ON CHROMOSOMES IN SEEDS

By

L. G. Dubinina\*

The effect of dynamic and radiation factors has been shown on many objects as well as weightlessness on the genetic structures of cells (Dubinin, 1967).<sup>1</sup> Some of these questions were studied with the use of *C. capillaris*. /106

The *C. capillaris* seeds preserved in a dry state above KOH for five days were on a space satellite. For the control seeds on earth the frequency of mutations after their treatment with EI in a concentration of  $9.3 \cdot 10^{-3}$  M was  $19.01 \pm 1.2\%$ . When the seeds were treated with EI in the same concentration after the flight the frequency of mutations in them was  $36.0 \pm 1.9\%$ . The spectrum of mutations contained a large number of mutations of the chromosomal type; cells with multiple rearrangements were also noted. In seeds not exposed to the effect of EI, after the flight a small increase was established in the level of mutability (Dubinina, Chernikova, 1970). The cited data demonstrated that the space flight factors induce potential chromosomal changes in the *C. capillaris* seeds. These changes were found in additional mutagenic treatment with ethylenimine. /107

A number of phenomena were established in a study of the consequences of pre- and postflight irradiation with  $\gamma$ -rays of the *C. capillaris* seeds (Anikeyeva, Vaulina, 1972; Vaulina et al., 1975). First, in the nonirradiated material a certain increase was observed in the number of chromosomal rearrangements in the meristem cells of the rootlets; second, the phenomenon of sensitization of the

---

\* Institute of General Genetics, USSR Academy of Sciences

\*\*Numbers in margin indicate pagination in original foreign text.

<sup>1</sup>Translator's Note: The references are not attached.

mutation process was found for seeds that before the flight were irradiated on earth; third, a reduction in the radio-sensitivity of the seeds after the space flight was revealed.

E. N. Vaulina and L. N. Kostina (Vaulina, Kostina, 1975; Vaulina, Kostina, 1976) investigated the independent and modifying effect of vibration and linear acceleration under ground conditions with simulation of the factors active in a space flight. The effect of vibration was studied with the help of the wide-band random process on a tape recorder with maximum spectral density. The magnitude of vibration equalled 300-800 Hz. For the linear acceleration a centrifuge was used; the magnitude of acceleration reached 6-8 g. It was established that vibration and linear acceleration induce chromosomal rearrangement in cells of *C. capillaris* plantules, as well as increase in the frequency of chromosomal-type rearrangements. The studied dynamic factors modify the effect of radiation. The authors irradiated air-dried seeds of *C. capillaris* with  $\gamma$ -rays  $^{137}\text{Cs}$  in a dose of 3 kr (power 517 r/min). The irradiated seeds under ground conditions were exposed to vibrations and linear acceleration. A reduction was found in the radio-sensitivity of the seeds to the subsequent  $\gamma$ -irradiation.

In a study of the chromosomal structures of *C. capillaris* cells in seeds after flight on the craft "Soyuz-9," "Salyut," and "Zond-8" it was found that certain cells experienced many chromosomal damages. Such damages occurred among the mass of normal cells. The authors hypothesize that the cause of the damages to individual cells manifest in numerous damages to chromosomes is the effect of space radiation energy introduced into the cell by non-leptons under conditions of weightlessness (Akoev et al., 1975).